APPENDIX 6.

Appendix 6A: Soil Identification in the Field

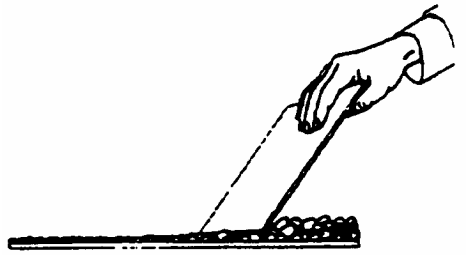
Distinguishing Soil Types in the Field

When laboratory facilities are not available, some simple field tests can help you distinguish soil types and determine gradation, plasticity and dispersion:

Gradation

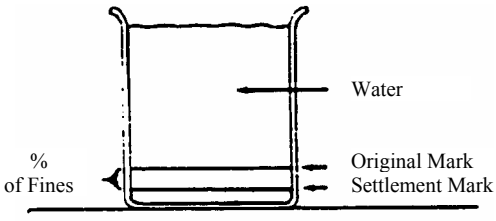
To judge gradation of dry soil, spread a sample on a flat surface. Separate the larger and smaller particles with a piece of stiff paper or cardboard. Estimate the percentage of particles larger than 1/4 in. (6mm) and the percentage of fines - individual grains too small for you to see with the unaided eye. Finally, gauge whether the larger particles are uniform in size (poorly graded) or have an assortment of sizes (well graded).

Figure 1 - Gradation Test



If the soil is wet, break a lump apart. Estimate the percentage of large particles as in the dry soil method. To find the percentage of fines, put just enough water in a clear glass to cover the bottom and fill the glass 1/4 full with soil. Then add enough water to just cover the soil and mark this level with a rubber band.

Figure 2 - Percent of Fines



Now add water to the 3/4 mark and stir the mixture vigorously. After it settles for a minute and a half, mark the height of soil that has settled out. The difference between the two marks as a portion of the height of the upper mark approximates the percentage of fines.

Plasticity

Here are four field tests for estimating a soil's plasticity.

The Shaking Test: Knead a sample of the soil to work out as many large grained particles as possible. Add water gradually and knead the soil until it begins to get sticky.

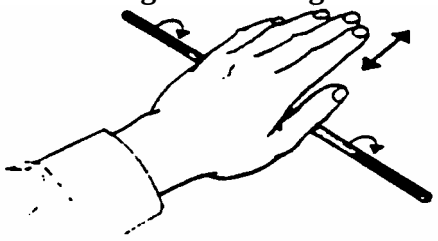
Figure 3 - Shaking Test

Then hold the ball in one hand and tap the back of the hand with the other. If the ball becomes wet and shiny, it is mostly fine sand or silt. No reaction suggests clay.

The Toughness Test: Use the ball from the shaking test. Knead about half of it until it's dry. Then roll the soil sample into a 1/8 in. (3mm) thread or "worm". If you can't form a worm, the soil is sand or silt or fine sand (low plasticity).

Highly plastic soils take a long time to dry and become hard and waxy. You have to exert a lot of pressure to form a worm that breaks at about 1/8 in. diameter.

Figure 4 - Toughness Test

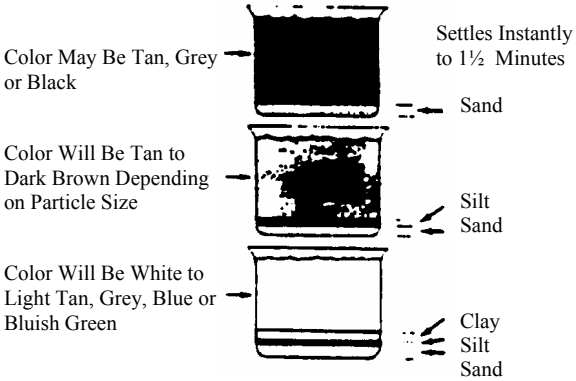


The Dry Strength Test: Knead the other half of the sample into a ball and let it air dry. Then break it apart and select a jagged, pointy fragment. Try to crush this fragment between your thumb and forefinger. A silt will turn to powder with little effort. A clay will be hard and almost impossible to crush.

Hand Washing: After handling silts and sands, your fingers will feel dusty. Rubbing them together will almost clean them. Gently flowing water will rinse them.

If you've been handling clay, you'll find a crust on your fingers you cannot rub off. Water will not rinse it off. You have to rub your hands together under water to cleanse them.

Figure 5 - Dispersion Test



Dispersion

Use a dispersion test to support your gradation estimates. It will also give you an idea of how difficult the soil will be to compact. First fill a glass 1/4 to 1/3 full with soil and then add water to within 1/2 in. (13mm) of the top. Stir the mixture well and set it aside.

The mixture will settle in three layers: sand at the bottom, silt in the middle and clay at the top. Besides showing the relative amounts of the three soils, the results will indicate whether the soil is well or poorly graded.

Although silt and clay particles are smaller than the eye can see, gradation difference will show up as color differences. Also, the longer it takes a layer to settle, the smaller the particles. Usually, a single particle size (poor gradation) and a small particle size mean more difficult compaction than a mix with good gradation.

Summary of Identifying Clues

To summarize how various soil types react to the field tests:

- Clay - No reaction to the shaking test; a tough worm that dries out slowly; a crusty dry residue that is hard to remove from the hands.
- Silts - Rapid reaction to the shaking test; a weak or crumbly worm; powdery residue that is easily wiped or washed off the hands.
- Silt and Clay Mixtures - Intermediate or conflicting reactions to hand tests.
- Sand or Gravel with a few Fine Clays - Enough clay to soil the hand when you knead a wet sample, but not enough to form a lump.
- Sand or Gravel with Silt Fines - Dusty or gritty fines.
- Clean Sands and Gravels - Added water sinks in immediately without making mud.

Soil Test Checklist

Watch for these possible reactions when you are using in-field do-it-yourself soil tests.

1. No reaction to the shaking test, a tough worm that dries slowly, and a crusty residue that is hard to remove from your hands indicates the soil is clay.
2. Rapid reaction to the shaking test, a weak or crumbly worm, and powdery residue that washes easily from your hands indicates silt.
3. Intermediate or conflicting reaction to hand tests indicate silt as well as clay mixtures.
4. Enough clay to soil your hands when you knead a sample, but not enough to form a lump indicates sand or gravel with a few fine clays.
5. Dusty or gritty fines indicates sand or gravel with silt fines.
6. When added water sinks in immediately without making mud, you will have clean sands and gravels.

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Appendix 6B: Additional Worksite in Focus

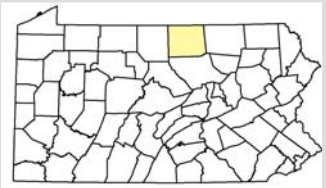
The following worksite is an additional project undertaken by a Pennsylvania local township with major funding through the Pennsylvania Dirt and Gravel Road Program. This worksite reused berm and ditch dirt to provide the needed topsoil cover for coalmine spoil to form a new wide vegetated buffer roadside area. The area was then fertilized and seeded. Although additional road and drainage work were part of the combination of practices used, the new, well-vegetated roadside buffer area reduces dust generation and keeps sediment out of nearby Fall Brook stream.

In addition, please refer back to Appendix 5 to the first Worksite on Red Rose Road in Huntington County, PA, to view the selected tree removal and bank stabilization practices utilized on that project.

Worksite in Focus

Tioga County
Fall Brook Road

4/13/05



Project Background
Fall Brook Road was used as a coalmining operations haul road until the early 1980's. Constructed of coalmine spoil, the road width, in some places, exceeded 60' wide. When coal trucks quit using the road, Ward Township was left with a problem road that could not maintain crown and had constant potholes. The road surface of coalmine spoil was very acidic, very soft and fine, holding and pumping water. Additionally, the coalmine spoil would not support vegetation, so the berms, ditches and banks were barren and a constant source of erosion. The road had inadequate cross pipes, groundwater in the road, and direct sediment discharges into Fall Brook.

Project Considerations
This segment of road has 2 stream crossings. One of these crossings, inadequate for flood flows, saw high water bypass the existing stream crossing and spill across the road about 300' away.

Project Facts

Project:	Fall Brook Road
Project Owner:	Ward Township
Affected Watershed:	Fall Brook, Tioga River
Project Length:	1100 ft
Date Completed:	September 2001

Cost Summary

Total Project Value:	$24,960
District Funding:	$21,185
Materials	$17,070
Equipment	$3,965
Labor	$150
In-Kind Contributions:	$3,775
Labor	$3,775

For More Information

The Center for Dirt and Gravel Road Studies
(814) 865-5355
www.dirtandgravelroads.org

Tioga County Conservation District
Ralph Brugger
(570) 724-1801

Before: Fall Brook Road was so wide, the township could not keep the road crowned. The road surface of coalmine spoil held water and was full of potholes during wet periods and was a constant source of dust in the summer. High flows sent water flooding across the road eroding the surface material directly into Fall Brook. Although already impacted by acid mine drainage, Fall Brook did not need an additional source of impairment.

The publishers of this publication gratefully acknowledge the financial support of the Pennsylvania State Conservation Commission. For additional information or assistance, contact: Center for Dirt & Gravel Roads Studies, Penn State University, 207 Research Unit D, University Park, PA 16802 (Toll-Free Phone: 1-866-668-6683, Fax: 814-863-6787, Email: dirtandgravel@psu.edu). Additional copies available on our website at: www.dirtandgravelroads.org

Center for Dirt and Gravel Road Studies

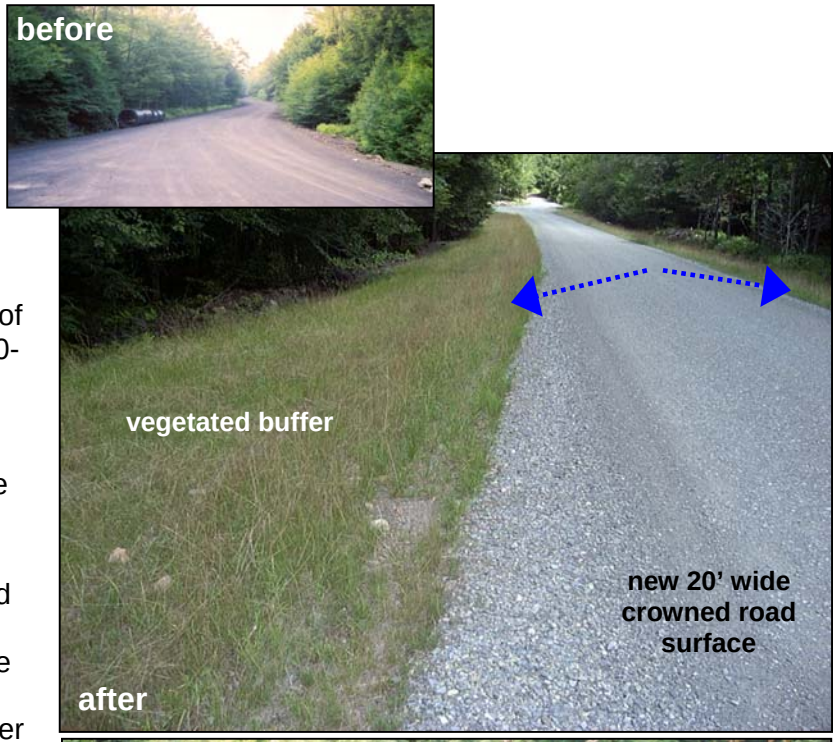
Project Solutions

Construct new road base: To solve the problem of the wide flat road, the township used the existing road surface of coalmine spoil to construct a new crowned road base.

Re-surface the road: The centerline of the new roadway was laid out and a 20-foot wide layer of limestone Driving Surface Aggregate (DSA) was placed and compacted. The newly crowned road surface sheds water to either side as sheet flow.

Vegetate road berms: With the extra width to work with, the township hauled berm and ditch dirt from other roads in the township and covered the coalmine spoil with 6" of topsoil, forming wide buffer areas (see photo at right). Buffer areas, banks and ditches were limed fertilized and seeded.

Stabilize stream crossings: One of the two stream crossings on this project needed to be replaced. A new pipe and head- and endwalls were installed. The township poured its own 2'x2'x4' concrete blocks to construct the headwalls (see photo at right). Additional cross pipes were added to direct ditch water to the vegetated buffer, removing a direct discharge to the stream. At the other crossing, high flows flooded the road 300' away. Where high water crossed the road, the road and road base were armored with R5 rip-rap to allow water to flow over the road without major damage.

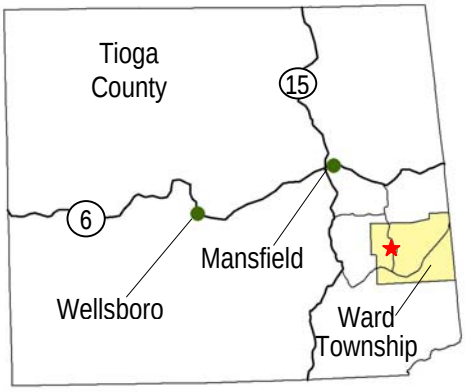


Project Results

Previously, Fall Brook Road required frequent regular maintenance and emergency maintenance following high water flooding. Since project completion in 2001, the township has only had to grade twice. The road itself has a new durable driving surface. Well-vegetated buffer areas reduce dust generation and keep sediment out of Fall Brook.

Site Map & Directions

From U.S. Route 6, turn left on to State Route 2029 in Mainesburg. State Route 2029 turns into State Route 2022, then into Fall Brook Road. The project begins approximately 3 miles down Fall Brook Road at the intersection of the road with Fall Brook.



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